





# A CALL TO GREEN ACTION

CAL POLY TURNED ITS ATTENTION to the challenge of meeting global energy needs at this year's Baker Forum in May.

Titled "Achieving Sustainable Solutions to the Global Energy and Environmental Challenge," the event brought together leaders from education, industry and government to discuss and define the problems likely to stem from the inevitable transition to a "post-oil" world.

The forum's focal point was a keynote address by David Goodstein, vice provost and a professor of physics and applied physics at Caltech, on trends in petroleum supply and demand, the environmental impact of continued reliance upon petroleum sources of energy, and potential technological solutions. (See next page)

Goodstein, author of "Out of Gas: The End of the Age of Oil," was presented with the 2006 Wiley Lifetime Achievement Award for his work in the areas of education, research and public policy. Established in 2002 with support from John Wiley & Sons Inc. and bestowed at each Baker Forum, the award recognizes individuals whose work exemplifies extraordinary leadership and lasting contributions to American higher education and public life.

"Through his path-breaking research, David Goodstein has helped answer fundamental questions about the universe. Through his teaching, he has made physical principles accessible to generations of Caltech students and the wider public. Through his writings and public service, he has also helped focus our attention on critical public policy issues," said Cal Poly President Warren J. Baker.

The forum also featured panel presentations by several additional speakers and group discussions. Participants identified options for Cal Poly (and other polytechnic and science and technology universities) to respond to the world's emerging energy challenges in partnership with business and government.

Administrators say the campus is in the early stages of applying some of what emerged at the forum to specific curriculum and research initiatives, potentially in collaboration with partners in education, industry and government. In addition, forum proceedings will be disseminated to a wide group of state and national leaders.

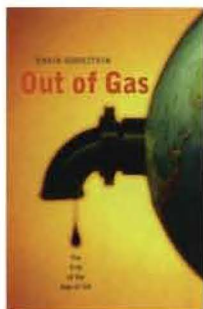
Cal Poly's environmental efforts extend far beyond policy discussions and keynote addresses, however. As you'll read on the following pages, the campus is pursuing an abundance of environmentally conscious initiatives. □

THE BAKER FORUM WAS ESTABLISHED IN 2002 by the Cal Poly President's Cabinet, on the occasion of the 20th year of service to Cal Poly by President Warren J. Baker and his wife, Carly, to further the dialogue on critical public-policy issues facing the nation and higher education. It gives particular attention to the special social and economic roles and responsibilities of polytechnic and science and technology universities.

Envisioned as a biennial event, the Baker Forum provides an opportunity for polytechnic and science and technology university presidents and industry leaders to come together in an issue-focused, highly interactive setting, designed to promote international dialogue, highlight issues of critical importance and stimulate creative responses.



# GOODSTEIN: A CIVILIZATION IN PERIL



DAVID GOODSTEIN, CAL TECH PHYSICIST and author of "Out of Gas: The End of the Age of Oil," shared stark predictions about the global energy situation, as he addressed the 2006 Baker forum at Cal Poly.

Characterizing as "myth" the view that the marketplace will magically produce adequate alternatives when the global oil supply is exhausted

later this century, he also explained that most of the alternative energy supplies known today have serious drawbacks.

As currently constituted, the alternatives are unlikely to be able to meet the enormous energy needs of the world's growing population. "Fusion and shale oil are the fuels of the future, and they always will be," he quipped.

Hydroelectric power has been built to full capacity, coal is

an environmentally dirty fuel that will worsen the greenhouse effect, and wind is too undependable. "We may inherit the wind but we'll never live on it," he said.

Discussing transportation, he cited Amory Lovin's ideas about "feebates" and rebates to tax energy guzzlers and subsidize fuel-efficient modes, but, as with advanced batteries, hydrogen-powered alternatives, he fears we "understand the principle but lack the will."

Goodstein, himself the owner of a Toyota Prius hybrid vehicle, issued this dire warning: "Civilization as we know it will come to an end sometime in this century, when the fuel runs out," if we don't mobilize quickly and massively to develop global solutions.

The only real hope lies with solar and nuclear energy sources, he concluded – adding in a rare indulgence of optimism, "But we are good with technological fixes." □



# A CAMPUS TURNING GREEN

ASK MARK HUNTER (CM '87) to expound on the ways in which Cal Poly is working to curb its energy consumption and otherwise lessen the environmental impact of campus operations, and you're likely to get a dispassionate recitation of facts relating to various programs and initiatives.

Don't mistake his calm demeanor for indifference, though. In point of fact, Hunter is a driven environmentalist, particularly where facilities and operations at Cal Poly are concerned, and he's got a record of achievement to prove it.

Hunter, who directs Facility Services at the university, has overseen numerous initiatives as part of a sustainability and conservation program that he developed with his staff of about 150. The efforts include retrofitted lighting, upgraded heating and cooling systems, and room-occupancy sensors.

"We're very excited about instilling an interest in and a commitment to sustainability on campus," he says. "And we're especially excited about the campus moving toward renewable energy."

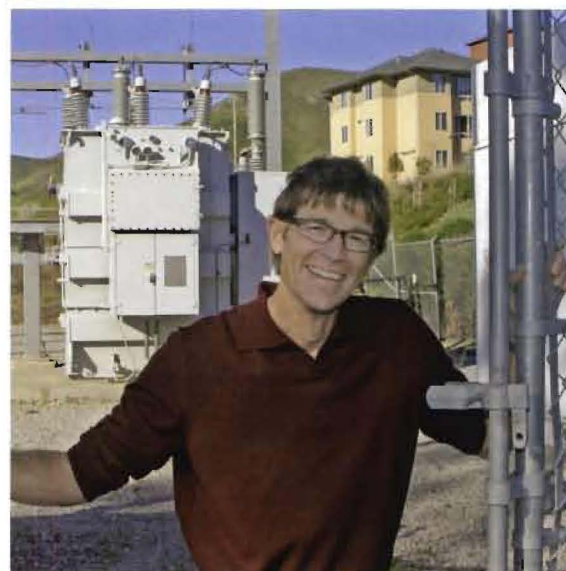
On the latter front, Cal Poly's Engineering West Building has a new solar roof, thanks to The California State University and SunEdison. Cal Poly is one of three CSU campuses, along with Dominguez Hills and Chico, participating in a system-wide pilot program administered by the Chancellor's Office and the Department of General Services.

The program is intended to lower energy costs, promote renewable energy use, and make CSU campuses more environmentally friendly. Engineering West was selected, in part, because its roof was already scheduled for replacement.

As part of a third-party power purchase agreement, contractor SunEdison built and will own, operate and maintain the system. The firm will also pay for costs associated with liability and system performance. Cal Poly will bear no expense and under the agreed rate structure can expect a modest cost savings over 20 years.

"It's our first foray into solar energy on campus, but I expect it won't be our last," says Hunter, who estimates the panels will supply about 1 percent of the campus's electricity needs.

In fact, Cal Poly has reduced its energy usage by 15 percent over the last five years, and recently received awards from the California Higher Education Energy Partnership for its efforts in the areas of load management, retrofitting heating and cooling systems, and student energy conservation. The university also has contracted with Chevron Energy Solutions to help identify where further improvements can be made.



Mark Hunter (Photo by Tony Hertz)

## ELSEWHERE, THE CAMPUS HAS:

- Initiated a program to recycle campus construction waste (the campus exceeds the state-mandated requirement to recycle 50 percent of its waste flow)
- Instituted a biomass tub for converting food-related waste to mulch and compost
- Fitted 15 percent of the Facilities Services fleet to run on alternative fuels
- Installed waterless urinals and low-flow toilets
- Begun using environmentally friendly cleaning materials

"The benefits of using natural resources efficiently are pretty obvious at this point. We've made some significant progress toward that end on campus, but there's still plenty more to do. Facilities Services is more than up to the challenge," says Hunter.

Cal Poly Facility Services, together with Facilities Planning & Capital Projects, and in cooperation with the Sustainability Advisory Committee, has published the "Biennial Progress Report 2006: Sustainability at Cal Poly," which contains information about energy use, transportation, water resources, solid waste and recycling, and land use.

"The report not only highlights some of the great work done by Hunter's folks, but also shows how sustainability is a growing concern throughout the campus," says Mike Multari, a Cal Poly planner and sustainability coordinator who helped prepare the document.

"For example, efforts are under way to reduce automobile use and to promote alternative transportation, to protect prime agricultural soils and sensitive habitats on Cal Poly lands, and to demonstrate effective organic farming here in San Luis Obispo and 'green' timber practices at Swanton Pacific."

The report can be viewed online at [www.facilities.calpoly.edu/campusprojects/sustainability/SusInd06.pdf](http://www.facilities.calpoly.edu/campusprojects/sustainability/SusInd06.pdf). □



NEAL MACDOUGALL IS THE FIRST TO ADMIT that theory has its place in a university setting. When it comes to sustainable agriculture, though, he's quick to point out that actions speak louder than words.

"We want to have an impact, we want to make a difference," he says of the Cal Poly Sustainable Agriculture Resource Consortium (SARC), a program devoted to advancing sustainable food and agriculture systems.

MacDougall, an associate professor of agribusiness at Cal Poly, is SARC's faculty director – and its most ardent champion.

SARC initiatives include the Cal Poly Organic Farm, an 11-acre spread where students learn crop and animal husbandry.

The consortium also offers workshops, events and a Community Supported Agriculture program enabling community members to share in the organic farm's bounty on a subscription basis.

Through it all runs a common theme: food production acutely attuned to the needs of both the community and environment.

"The fascinating thing about agriculture is that it provides a crucible for a host of sustainability issues," says MacDougall, whose research interests include organic policy research and food production.

"The movement toward sustainability is not a destination; it's a process." □



Linda Vanasupa and her students are using hydrogen fuel cells to produce hydrogen from renewable energy sources.

FOR LINDA VANASUPA, the key to achieving meaningful progress on sustainability issues is educating future engineers to approach their work from a radically different perspective.

Such is the animating idea behind the campus's EdGE (Educating Global Engineers) Initiative, a five-year pilot program, funded in part by the National Science Foundation, aimed at fundamentally changing engineering curriculum and instruction.

The goal, according to Vanasupa, is to promote design and development practices that take environmental and societal needs into consideration. The initiative's slogan is Serving Society Through Innovation.

"We're completely changing the way students experience their course work," explains Vanasupa, a professor of materials engineering at Cal Poly who was recently named director of the EdGE Initiative. "Classroom instruction will center on projects, and teachers will serve more as coaches."

The program currently involves some 150 materials engineering undergraduates, but Vanasupa would like to see its bold new approaches spread to other engineering disciplines, and ultimately to other universities.

"What we're trying to do is redefine the engineering profession in the context of global society's needs," she says. □



IN THE ROCKY TIDAL AREAS that dot Morro Bay's picturesque coastline, biologist Lars Tomanek and his research team are looking for clues as to how marine organisms might react to future temperature increases. And what they've discovered is cause for concern.

At low tide, the internal temperature of the black turban snail rises up to 20 degrees Celsius as a result of exposure to sunlight. Like other species that inhabit coastal intertidal zones, the black

THE BLACK TURBAN HAS DEVELOPED  
A SPECIALIZED BIOCHEMICAL  
RESPONSE THAT ENABLES IT TO COPE  
WITH REGULAR THERMAL VARIATIONS.

turban has developed a specialized biochemical response that enables it to cope with regular thermal variations.

When subjected to abnormally high temperatures in "acclimation" experiments, however, the black turban has proved incapable of producing the necessary levels of protective proteins, suggesting that such organisms may have limited means of combating new temperature extremes. In contrast, brown turban snails, which remain submerged in subtidal areas, have shown themselves to be surprisingly adaptable in the face of temperature increases, according to Tomanek.

"The upshot is we may be surprised about which species are ultimately affected by temperature change," he says. "Some may adapt, while others could well vanish." □

Lars Tomanek and research associate Betsy Turner collect specimens at the T-pier in Morro Bay.



WHEN THE CONVERSATION TURNS to sustainability and green building issues, count on Margot McDonald evincing an almost boundless enthusiasm for an array of related initiatives. Invariably, she'll have firsthand knowledge of several more.

McDonald, a professor of architecture and co-director of the Renewable Energy Institute at Cal Poly, has lent her talents to a broad spectrum of sustainable development efforts, including serving as principal investigator on the Sustainable Environmental Design Education program, a comprehensive curriculum framework funded by the California Integrated Waste Management Board, and advisor to the American Institute of Architect's initiative to reduce CO<sub>2</sub> emissions from building operations by 2010.

Earlier this year, she was appointed chair of the U.S. Green Building Council's Formal Education Committee, and elected to the board of directors of the American Solar Energy Society.

If there's a common theme throughout it all – aside from McDonald's own indefatigability – it's a conviction that sustainability is a fundamentally important concept.

"We need to get to the point where sustainability is fully integrated in what we teach so that green architecture – which encompasses things like solar heating and low-energy cooling – becomes standard practice," she says. □





WHEN PAUL WACK BEGAN teaching city and regional planning at Cal Poly in the late 1970s, academic insularity was an unspoken byword among faculty architects and planners.

As evidence of climate change stemming from development and construction practices steadily mounted, Wack was increasingly at the forefront of efforts to introduce an interdisciplinary approach to educating tomorrow's planners and designers. The campaign has begun to bear fruit.

"The walls have been broken down," says Wack, a professor of city and regional planning and an active supporter of the Sustainable Indicators Program, an initiative to link student and community sustainability efforts on California's Central Coast.

He was heartened by the Baker Forum, which brought to-

IT'S AN ELEMENTAL PROPOSITION: Before we can further reduce air pollution we must thoroughly understand the nature of the problem. That's where Andrew Kean comes in.

Kean, an assistant professor of mechanical engineering at Cal Poly, is in the midst of a two-year effort to measure vehicle particle emissions in the San Francisco Bay area. The scientific record on the subject is surprisingly limited.

He also recently completed a research proposal to develop and build a working model of a device to collect carbon dioxide – a greenhouse gas – directly from the air. Though studies have shown the potential feasibility of such a device, no prototypes have been built.

"It's a relatively new area of inquiry," he says. "That's the challenge."

An enthusiastic teacher, Kean is intent on fostering a mature environmental outlook in his students. Accordingly, he has developed a general education course on consumer decisions and their connection to energy consumption, natural resource degradation, climate change and social upheaval.

"My overarching aim is to educate students and the public about the opportunities we have every day to have a positive impact on the environment." □

'DENIAL IS NOT AN OPTION AND THE STATUS QUO IS NOT AN OPTION, WHICH MEANS WE'RE GOING TO HAVE TO PREPARE STUDENTS TO DEAL WITH THESE ISSUES SUBSTANTIVELY AND SYSTEMATICALLY.'

gether experts from various fields to discuss environmental issues, sustainability and energy consumption. In a similar vein, Wack favors harnessing interdepartmental synergies to reform planning and design curricula.

"Most issues associated with climate change can be connected with how we use land, locally and globally," he says. "Denial is not an option and the status quo is not an option, which means we're going to have to prepare students to deal with these issues substantively and systematically." □